Chapter 5
RAIL IMPROVEMENT ALIGNMENT OPTIONS COMPARISON

5.1 INTRODUCTION

5.1.1 Purpose and Content of this Chapter

The purpose of this chapter is to summarize and compare the physical and operational characteristics and potential environmental consequences associated with the Rail Improvements alignment and station options. The comparison focuses on subject areas in which there are relative differences among the potential impacts of the various alignment options in each segment of the LOSSAN Corridor. This chapter summarizes potential environmental consequences for each alignment comparison for the environmental resource areas where relative differences were identified. (Refer to Chapter 3, Affected Environment, Environmental Consequences, and Mitigation Strategies, for a comprehensive presentation of potential environmental consequences in each environmental resource area.)

For many of the environmental topics discussed in this chapter, the quantities presented represent areas within which potential impacts might occur. For example, the area of floodplains includes all floodplains within 100 ft (30m) of either side of the centerline of the alignment considered; whereas the right-of-way necessary for the improvements considered is smaller (generally only 25 ft [7.6 m] on either side of the centerline for the Rail Improvements Alternative). Therefore the magnitude of potential impacts reported in this document is considerably larger than the actual impacts that would be expected from the proposed rail improvements.

5.1.2 Organization of this Chapter

The alignment option comparisons are presented in tabular form by segment. The station options are presented individually and compared where multiple options are considered for the same general station area. The alignment and station options are briefly described in the tables and illustrated on the associated maps. For each alignment comparison, the following summary information is presented and compared where relative differences were identified.

- Physical/operational characteristics.
  - Alignment.
  - Length.
  - Capital cost.
  - Travel time.
  - Ridership.
  - Constructability.
  - Operational issues.

- Potential environmental impacts.
  - Transportation and related topics (air quality, noise and vibration, and energy).
  - Human environment (land use and community impacts, aesthetics and visual resources, socioeconomics, utilities and public services, hazardous materials and wastes).
  - Cultural resources (archaeological resources, historical properties) and paleontological resources.
  - Natural environment (geology and seismic hazards, hydrology and water resources, and biological resources and wetlands).
  - Section 4(f) and 6(f) resources (certain types of publicly owned parklands, recreation areas, wildlife/waterfowl refuges, and historical sites).

Comparative data in the tables below are organized into the following rail segments.

- Los Angeles Union Station to Irvine
- Irvine to Oceanside
- Oceanside to San Diego Santa Fe Station

There were numerous alignment and construction options evaluated in the Rail Improvements Alternative. To allow a reasonable comparison of alignment options, a range of potential impacts is represented in the following tables by two or more of many possible route alignment combinations between Union Station and San Diego, using -- the highest level of improvements, and the lowest level of improvements that could occur within each rail segment. The highest level of improvement is based on combining the alignment/construction options within a rail segment that would involve the most extensive infrastructure investment and/or construction complexity. For example, where there is an at-grade option and a trenching option in the same general alignment, the trenching option was used in the highest-level route and the at-grade option was used in the lowest-level route. Where two tunnel options are the only options in one sub-segment, the longer tunnel was included in the highest-level route. In this way, a range of potential impacts could be bracketed to allow a valid comparison of corridor-wide improvement options.

5.2 LOS ANGELES UNION STATION TO IRVINE ALIGNMENT OPTIONS

All information presented is for the area from Los Angeles to Irvine. This segment is shown in Figure 5.2-1

	Proposed Rail Improvements Alternative	
	LOSSAN Corridor Highest level of improvement to Irvine	**LOSSAN Corridor Lowest level of improvement to Irvine**
Alignment Description	This alignment would provide improved service along a fully grade-separated system, with bypass tracks at station locations. Station options considered in this segment include Fullerton Transportation Center, Anaheim Transportation Center, Santa Ana Regional Transportation Center, and Irvine Transportation Center.	This alignment would provide improved service along a partially grade-separated system. Station options considered in this segment include Fullerton Transportation Center, Anaheim Transportation Center, Santa Ana Regional Transportation Center, and Irvine Transportation Center.
Length miles (km)	43.9 mi (70.7 km)	43.9 mi (70.7 km)
Cost (dollars)	$1.59 billion	$1.45 billion
Travel Time (min)	38 min	41 min
Ridership	Additional reliability due to full grade-separation will boost ridership.	
Constructability	Within existing rail right-of-way. Would require additional right-of-way and construction of extensive grade separations while maintaining existing service. Would require construction of trenched segments.	Within existing rail right-of-way. Would require additional right-of-way and construction of partially grade-separated system while maintaining existing service.
Operational Issues	Fourth main track between Los Angeles and Fullerton would allow segregation of freight and passenger trains, assuming additional track modifications approaching Fullerton and Los Angeles Union Station (LAUS). Improvements would benefit freight, passenger, and commuter services.	Fourth track between Los Angeles and Fullerton would allow segregation of freight and passenger trains, assuming additional track modifications approaching Fullerton and LAUS. Remaining at-grade crossings would present a challenge for safety and reliability. Improvements would benefit freight, passenger, and commuter services.
Travel Conditions	Infrastructure improvements would provide benefits to existing rail services. The fully grade-separated LOSSAN corridor would improve traffic flow and reduce air pollution at existing rail crossings.	Increased train frequencies at remaining at-grade crossings would have some potentially negative traffic impact. Infrastructure improvements would provide benefits to rail services.
Noise and Vibration:[1] High, medium, and low potential impacts	Medium potential impacts. There would be an increase in noise levels due to increased frequency of trains. There would be a reduction in noise levels due to the elimination of horn noise and gate noise from existing services as a result of the grade separations at some existing grade crossings.	High potential impacts. No reduction of noise at grade crossings due to the lack of a fully grade-separated corridor.

[1] Generally, vibration is not a significant impact. However, sensitive and specific areas, such as historical structures and special habitats, could be affected.

	Proposed Rail Improvements Alternative	
	LOSSAN Corridor Highest level of improvement to Irvine	**LOSSAN Corridor Lowest level of improvement to Irvine**
Land Use and Planning, Communities and Neighborhoods, Property, and Environmental Justice	Compatible. Environmental Justice: Minority populations are present at points along this alignment option. Community: Low potential impacts. Property: High potential impacts.	Compatible. Environmental Justice: Minority populations are present at points along this alignment option. Community: Low potential impacts. Property: High potential impacts.
Aesthetics and Visual Resources: Number of viewing points and potential high contrast/impact areas	Low potential impacts. No viewing points are located along this alignment. Potential low impacts to high contrast/impact areas.	Low potential impacts. No viewing points are located along this alignment. Potential low impacts to high contrast/impact areas.
Hydrology and Water Resources:[2] Potential impacts and associated ac (ha) of floodplains, and linear ft (m) of streams within potential impact study areas	Floodplains: 75 ac (30 ha) Streams: 3,265 linear ft (995 linear m)	Floodplains: 75 ac (30 ha) Streams: 3,265 linear ft (995 linear m)
Biological Resources, Including Wetlands:[3] Linear ft of non-wetland waters (waters), number of special-species (species)	Waters: 20,780 linear ft (6,334 linear m) Special-Status Species: 5 Trains would travel in existing right-of-way within an urban area.	Waters: 20,780 linear ft (6,334 linear m) Special-Status Species: 5 Trains would travel in existing right-of-way within an urban area.
Section 4(f) and 6(f) Resources:[4] Number of resources rated high (potential direct effects)	Resources rated high: 7 Potential impacts would be limited due to the use of existing rail corridors in which few resources are found.	Resources rated high: 7 Potential impacts would be limited due to the use of existing rail corridors in which few resources are found.

[2] The hydrology and water resources study area is defined as 100 ft (30 m) on each side of the alignment centerline.

[3] The biological resources and wetlands study area is defined as 1,000 ft (305 m) for urban areas, 0.25 mi (0.40 km) for undeveloped areas, and 0.5 mi (0.80 km) for sensitive areas on each side of alignment centerline.

[4] The 4(f) and 6(f) resources study area is defined as 900 ft (274m) on each side of the alignment centerline. . Potential high impacts would be those that would occur within 150 ft (43 m) of alignment centerline.

5.3 IRVINE TO OCEANSIDE ALIGNMENT OPTIONS

All information presented is for the area from Irvine to Oceanside. This segment is shown in Figures 5.3-1a and 5.3-1b.

	Proposed Rail Improvements Alternative		
	Highest Level Improvements (I-5/LongTunnel/Double-Track)	**Highest Level Improvements (Trabuco Creek/Long Tunnel/Double-Track)**	**Lowest Level Improvements (Trabuco Creek/Short Tunnel/Double-Track)**
Physical/Operational Characteristics			
Alignment Description	The alignment would bypass San Juan Capistrano via an I-5 tunnel, include the long I-5 tunnel option with station through San Clemente and Dana Point, and complete double-tracking through Camp Pendleton. Station options considered in this segment include San Clemente Amtrak, and Oceanside Transit Center.	The alignment would bypass the existing San Juan Capistrano alignment via Trabuco Creek, include the long tunnel option with station through San Clemente and Dana Point, and complete double-tracking through Camp Pendleton. Station options considered in this segment include San Juan Capistrano Trabuco Creek, San Clemente Amtrak, and Oceanside Transit Center.	The alignment would bypass the existing San Juan Capistrano alignment via Trabuco Creek, include the short tunnel option through San Clemente and Dana Point (including the at-grade curve realignment at Dana Point), and complete double-tracking through Camp Pendleton. Station options considered in this segment include San Juan Capistrano Trabuco Creek, San Clemente Amtrak, and Oceanside Transit Center.
Length in miles (km)	40.8 mi (65.7 km)	41 mi (66 km)	41.4 mi (66.6 km)
Cost (dollars)	$1.82 billion	$1.46 billion	$1.13 billion
Travel Time (min)	26 min	28 min	28 min
Ridership	Alignment would eliminate a station stop at San Juan Capistrano for intercity service (though Metrolink commuter rail service could be retained on this existing line).	Alignment would provide a new San Juan Capistrano station along Trabuco Creek, replacing the existing downtown station.	Alignment would provide a new San Juan Capistrano station along Trabuco Creek.
Constructability	This alternative would require tunneling (approximately 12.7 mi [20.4 km]).	This alternative would require tunneling (approximately 8.8 mi [14.2 km]) and could cross some environmentally sensitive habitats.	This alternative would require tunneling (approximately 5.6 mi [9.0 km]) and cross some environmentally sensitive habitats.
Operational Issues	Beneficial. Would provide safer and more reliable operating conditions by providing full grade separations and removing tracks from the beach.		Beneficial. Would provide safer and more reliable operating conditions by grade separating much of the alignment, but could retain Dana Point curve.

	Proposed Rail Improvements Alternative		
	Highest Level Improvements (I-5/LongTunnel/Double-Track)	**Highest Level Improvements (Trabuco Creek/Long Tunnel/Double-Track)**	**Lowest Level Improvements (Trabuco Creek/Short Tunnel/Double-Track)**
Travel Conditions	This alignment would provide the most improvement in travel times, allowing for double tracking of the entire segment. Consequences of this alignment would be the elimination of a station stop in San Juan Capistrano and the addition of a new station in San Clemente. The fully grade-separated corridor would improve traffic flow and reduce air pollution at existing rail crossings.	This alignment would provide improved travel times, allowing for double tracking of the entire segment. San Juan Capistrano would be served by a new station located along Trabuco Creek and a new station located in San Clemente. The fully grade-separated corridor would improve traffic flow and reduce air pollution at existing rail crossings.	This alignment would provide improved travel times, allowing for double tracking of most of the segment while keeping some of the scenic coastal route. San Juan Capistrano would be served by a new station located along Trabuco Creek, and the San Clemente Metrolink and Amtrak stations would be located at a single station along Avenida Pico. There would be ongoing speed restrictions through Capistrano Beach and potentially the Dana Point curve.
Potential Environmental Impacts			
Noise and Vibration:[5] High, medium, and low potential impacts	Low potential impacts. Minimal potential noise/vibration impacts as a result of extensive tunneling under existing transportation corridors. Would eliminate potential impact along coast by realigning the right-of-way. Would realign corridor away from historical buildings in San Juan Capistrano.		Low potential impacts. Minimal potential noise/vibration impacts as a result of extensive tunneling under existing transportation corridors, removing right-of-way from majority of coastal alignment. Some potential impact may still occur along the coast in Capistrano Beach. Would realign corridor away from historical buildings in San Juan Capistrano.
Land Use and Planning, Communities and Neighborhoods, Property, and Environmental Justice	Compatible. Environmental Justice: Minority populations are present at points along this alignment option. Community: Low potential impacts. Property: Low potential impacts. I-5 would avoid historical resources, and tracks would be removed from existing beach alignment.	Some incompatibility, but Trabuco Creek avoids historical resources. Environmental Justice: Minority populations are present at points along this alignment option. Community: Low potential impacts. Property: Medium potential impacts. Tracks would be removed from existing beach alignment.	Some incompatibility. Environmental Justice: Minority populations are present at points along this alignment option. Community: Low potential impacts. Property: Medium potential impacts. Potential impacts from increased frequencies of trains along Capistrano Beach.

[5] Generally, vibration is not a significant impact. However, sensitive and specific areas, such as historical structures and special habitats, could be affected.

	Proposed Rail Improvements Alternative		
	Highest Level Improvements (I-5/LongTunnel/Double-Track)	**Highest Level Improvements (Trabuco Creek/Long Tunnel/Double-Track)**	**Lowest Level Improvements (Trabuco Creek/Short Tunnel/Double-Track)**
Aesthetics and Visual Resources: Number of viewing points and potential high contrast/impact areas	Low potential impacts. Viewing points: 1 (distant, no impact). Potential beneficial impact for communities. Would remove tracks from beach alignment.	Low potential impacts. Viewing points: 1 (distant, no impact). Potential beneficial impact for communities. Medium potential impact on residential along Trabuco Creek. Would remove tracks from beach alignment.	Low potential impacts. Viewing points: 1 (distant, no impact). Potential beneficial impact for communities. Medium impact on residential along Trabuco Creek and Capistrano Beach. Would remove tracks from part of beach alignment.
Hydrology and Water Resources:[6] Potential impacts and associated ac (ha) of floodplains, and linear ft (m) of streams within potential impact study areas	Floodplains: 25 ac (10 ha) Streams: 2,475 linear ft (linear 754 m)	Floodplains: 5 ac (2 ha) Streams: 3,625 linear ft (linear 1,105 m)	Floodplains: 35 ac (14 ha) Streams: 4,020 linear ft (linear 1,225)
Biological Resources, Including Wetlands:[7] Ac (ha) of wetlands, linear ft (m) of non-wetland waters (waters), and number of special-status species (species).	Wetlands: 41 ac (17 ha) Waters: 6,105 linear ft (1,861 linear m) Special-Status Species: 14 Tunneling would limit the potential impacts. Would eliminate potential coastal impacts by removing tracks from beach.	Wetlands: 35 ac (14 ha) Waters: 11,425 linear ft (3,483 linear m) Special-Status Species: 14 Tunneling would limit the potential impacts. Would eliminate potential coastal impacts by removing tracks from beach.	Wetlands: 9 ac (4 ha) Waters: 17,325 linear ft (5,281 linear m) Special-Status Species: 14 Tunneling would limit the potential impacts.
Section 4(f) and 6(f) Resources:[8] Number of resources rated high (potential direct effects)	Resources rated high: 8	Resources rated high: 8	Resources rated high: 9 Continued operation along Doheny State Beach.

6 The hydrology and water resources study area is defined as 100 ft (30 m) on each side of the alignment centerline.

7 The biological resources and wetlands study area is defined as 1,000 ft (305 m) for urban areas, 0.25 mi (0.40 km) for undeveloped areas, and 0.5 mi (0.80 km) for sensitive areas on each side of alignment centerline.

8 The 4(f) and 6(f) resources study area is defined as 900 ft (274m) on each side of the alignment centerline. Potential high impacts would be those that would occur within 150 ft (43 m) of alignment centerline.

5.4 OCEANSIDE TO SAN DIEGO ALIGNMENT OPTIONS

All information presented is for the area from Oceanside to San Diego. This segment is shown in Figures 5.4-1a and 5.4-1b.

	Proposed Rail Improvements Alternative				
	Highest Level Improvements (Short Trench/ Peñasquitos Bypass/I-5 Tunnel/ Grade Sep.)	**Highest Level Improvements (Short Trench/ Peñasquitos Bypass/UTC Tunnel/ Grade Sep.)**	**Highest Level Improvements (Short Trench/Camino del Mar & UTC Tunnels/ Grade Sep.)**	**Lowest Level Improvements (At Grade/ Camino del Mar & UTC Tunnels/Grade Sep.)**	**Lowest Level Improvements (At Grade/Camino del Mar & UTC Tunnels/At Grade)**
Physical/Operational Characteristics					
Alignment Description	Would include short trench and cover through downtown Carlsbad and downtown Encinitas, bypass Peñasquitos Lagoon and Del Mar with tunnel under I-5, tunnel under I-5 to shorten alignment by bypassing Miramar Curve, and provide full-grade separation through San Diego. Station options considered in this segment include Solana Beach Transit Center and San Diego Downtown Santa Fe Depot.	Would include short trench and cover through downtown Carlsbad and downtown Encinitas, bypass Peñasquitos Lagoon and Del Mar with tunnel under I-5, tunnel under UTC, and provide full grade separation through San Diego. Station options considered in this segment include Solana Beach Transit Center, UTC, and San Diego Downtown Santa Fe Depot.	Would include short trench and cover through Carlsbad and Encinitas, tunnel under Camino del Mar and UTC, and provide full grade separation through San Diego. Station options considered in this segment include Solana Beach Transit Center, UTC, and San Diego Downtown Santa Fe Depot.	Would be at grade through Carlsbad and Encinitas with partial-grade separation, tunnel under Camino del Mar and UTC, and provide full grade separation through San Diego. Station options considered in this segment include Solana Beach Transit Center, UTC, and San Diego Downtown Santa Fe Depot.	Would be at grade through Carlsbad and Encinitas, tunnel under Camino del Mar and UTC, and be at grade through San Diego. Station options considered in this segment include Solana Beach Transit Center, UTC, and San Diego Downtown Santa Fe Depot.
Length in miles (km)	36.4 mi (58.6 km)	37.2 mi (59.9 km)	37.2 mi (59.9 km)	37.2 mi (59.9 km)	37.2 mi (59.9 km)
Cost (dollars)	$2.04 billion	$1.96 billion	$1.77 billion	$1.47 billion	$1.19 billion
Travel Time (min)	25 min	27 min	29 min	29 min	29 min
Ridership		Alignment would provide a new potential underground UTC station.	Alignment would provide a new potential underground UTC station.	Alignment would provide a new potential underground UTC station.	Alignment would provide a new potential underground UTC station.

	Proposed Rail Improvements Alternative				
	Highest Level Improvements (Short Trench/ Peñasquitos Bypass/I-5 Tunnel/ Grade Sep.)	**Highest Level Improvements (Short Trench/ Peñasquitos Bypass/UTC Tunnel/ Grade Sep.)**	**Highest Level Improvements (Short Trench/Camino del Mar & UTC Tunnels/ Grade Sep.)**	**Lowest Level Improvements (At Grade/ Camino del Mar & UTC Tunnels/Grade Sep.)**	**Lowest Level Improvements (At Grade/Camino del Mar & UTC Tunnels/At Grade)**
Constructability	Requires considerable earth moving from trenching and tunneling (approximately 12.2 mi [19.6 km]). Avoids tunneling under main commercial street in Del Mar.	Requires considerable earth moving from trenching and tunneling (approximately 10.5 mi [16.9 km]). Avoids tunneling under main commercial street in Del Mar.	Requires considerable earth moving from trenching and tunneling (approximately 7.7 mi [12.4 km]).	Requires some earth moving from trenching and tunneling (approximately 6.2 mi [10.0 km]).	Requires some earth moving from trenching and tunneling (approximately 6.2 mi [10.0 km]).
Operational Issues	Beneficial. Reduces operational issues in Del Mar by eliminating bluff alignment. Overall speeds greatly improved by bypassing Soledad grade through Miramar Curve and grade separation of crossings. Does not provide station at UTC.	Beneficial. Reduces operational issues in Del Mar by eliminating bluff alignment. Speeds improved by bypassing Soledad grade through Miramar Curve and grade separation of crossings.	Beneficial. Eliminates operational issues in Del Mar by eliminating bluff alignment and providing the straightest, flattest alignment through Del Mar. Speeds improved by bypassing Soledad grade through Miramar Curve and grade separation of crossings.	Beneficial. Eliminates operational issues in Del Mar by eliminating bluff alignment and providing the straightest, flattest alignment through Del Mar. Speeds improved by bypassing Soledad grade through Miramar Curve and grade separation of crossings in San Diego. At-grade issues remain in Carlsbad and Encinitas.	Somewhat beneficial. Eliminates operational issues in Del Mar by eliminating bluff alignment and providing the straightest, flattest alignment through Del Mar. Ongoing reliability issues due to remaining grade crossings.

	Proposed Rail Improvements Alternative				
	Highest Level Improvements (Short Trench/ Peñasquitos Bypass/I-5 Tunnel/ Grade Sep.)	**Highest Level Improvements (Short Trench/ Peñasquitos Bypass/UTC Tunnel/ Grade Sep.)**	**Highest Level Improvements (Short Trench/Camino del Mar & UTC Tunnels/ Grade Sep.)**	**Lowest Level Improvements (At Grade/ Camino del Mar & UTC Tunnels/Grade Sep.)**	**Lowest Level Improvements (At Grade/Camino del Mar & UTC Tunnels/At Grade)**
Potential Environmental Impacts					
Travel Conditions	Would improve travel times, allowing for double tracking of the entire segment and grade separations through north San Diego County and San Diego. The fully grade-separated corridor would improve traffic flow and reduce air pollution at existing rail crossings.	Would improve travel times, allowing for double tracking of entire segment and grade separations through north San Diego County and San Diego. This option would also provide for a potential station at UTC, serving the businesses and residents of UTC/Sorrento Valley and students at UC-San Diego. The fully grade-separated corridor would improve traffic flow and reduce air pollution at existing rail crossings.		Would considerably improve travel times, allowing for double-tracking of the entire segment and grade separations through San Diego. This option would also provide for a potential station at UTC, serving the businesses and residents of UTC/Sorrento Valley and students at UC San Diego.	Would considerably improve travel times, allowing for double-tracking of the entire segment and partial grade separations through San Diego. This option would also provide for a potential station at UTC, serving the businesses and residents of UTC/Sorrento Valley and students at UC San Diego.
Noise and Vibration:[9] High, medium, and low potential impacts	Medium potential impacts. Some noise/vibration would potentially continue to impact San Dieguito Lagoon and some residential areas. Could introduce new potential impacts along southern edge of San Dieguito Lagoon.		Low potential impacts. Some noise/vibration would potentially continue to impact lagoon areas.	Low potential impacts. Some noise/vibration would potentially continue to impact lagoons and some residential areas due to at-grade segments through Encinitas and Carlsbad.	Low potential impacts. Noise/vibration would potentially continue to impact lagoons and some residential areas due to at-grade segments through Encinitas, Carlsbad, and San Diego.

[9] Generally, vibration is not a significant impact. However, sensitive and specific areas, such as historical structures and special habitats, could be affected.

	Proposed Rail Improvements Alternative				
	Highest Level Improvements (Short Trench/ Peñasquitos Bypass/I-5 Tunnel/ Grade Sep.)	**Highest Level Improvements (Short Trench/ Peñasquitos Bypass/UTC Tunnel/ Grade Sep.)**	**Highest Level Improvements (Short Trench/Camino del Mar & UTC Tunnels/ Grade Sep.)**	**Lowest Level Improvements (At Grade/ Camino del Mar & UTC Tunnels/Grade Sep.)**	**Lowest Level Improvements (At Grade/Camino del Mar & UTC Tunnels/At Grade)**
Land Use and Planning, Communities and Neighborhoods, Property, and Environmental Justice	Some incompatibility. Environmental Justice: Low potential impacts. Community: Low potential impacts. Property: Low potential impacts.	Some incompatibility. Environmental Justice: Low potential impacts. Community: Low potential impacts. Property: Low potential impacts.	Some incompatibility. Environmental Justice: Low potential impacts. Community: Low potential impacts. Property: Low potential impacts.	Some incompatibility. Environmental Justice: Low potential impacts. Community: Low potential impacts. Property: Low potential impacts.	Some incompatibility. Environmental Justice: Low potential impacts. Community: Low potential impacts. Property: Low potential impacts.
Aesthetics and Visual Resources: Number of viewing points and potential high contrast/impact areas	Medium potential impacts. Viewing points: 1. Medium potential impacts on communities due to elevated rail structure along southern edge of San Dieguito Lagoon.	Medium potential impacts. Viewing points: 1. Medium potential impacts on communities due to elevated rail structure along southern edge of San Dieguito Lagoon.	Low potential impacts. Viewing points: 1. Beneficial potential impact on communities.	Low potential impacts. Viewing points: 1. Low potential impact on communities.	Low potential impacts. Viewing points: 1. Low potential impact on communities.
Hydrology and Water Resources:[10] Potential impacts and associated ac (ha) of floodplains, and linear ft (m) of streams within potential impact study areas	Floodplains: 120 ac (49 ha) Streams: 6,230 linear ft (1,899 linear m)	Floodplains: 100 ac (40 ha) Streams: 6,365 linear ft (1,940 linear m)	Floodplains: 140 ac (57 ha) Streams: 6,155 linear ft (1,876 linear m)	Floodplains: 140 ac (57 ha) Streams: 6,155 linear ft (1,876 linear m)	Floodplains: 140 ac (57 ha) Streams: 6,155 linear ft (1,876 linear m)

10 The hydrology and water resources study area is defined as 100 ft (30 m) on each side of the alignment centerline.

	Proposed Rail Improvements Alternative				
	Highest Level Improvements (Short Trench/ Peñasquitos Bypass/I-5 Tunnel/ Grade Sep.)	**Highest Level Improvements (Short Trench/ Peñasquitos Bypass/UTC Tunnel/ Grade Sep.)**	**Highest Level Improvements (Short Trench/Camino del Mar & UTC Tunnels/ Grade Sep.)**	**Lowest Level Improvements (At Grade/ Camino del Mar & UTC Tunnels/Grade Sep.)**	**Lowest Level Improvements (At Grade/Camino del Mar & UTC Tunnels/At Grade)**
Biological Resources Including Wetlands:[11] Ac (ha) of wetlands, linear ft (m) of non-wetland waters (waters), and number of special-status species (species)	Wetlands: 881 ac (357 ha) Waters: 56,437 linear ft (17,202 linear m) Special-Status Species: 37 Would improve tidal flow within coastal lagoons by replacing structures across lagoons to eliminate or reduce fill. Would bypass Peñasquitos Lagoon and remove existing fill along it, but could introduce new potential impacts along southern edge of San Dieguito Lagoon because would pass edge of lagoon.	Wetlands: 874 ac (354 ha) Waters: 53,962 linear ft (16,448 linear m) Special-Status Species: 37 Would improve tidal flow within coastal lagoons by replacing structures across lagoons to eliminate or reduce fill. Would bypass Peñasquitos Lagoon and remove existing fill along it, but could introduce new potential impacts along southern edge of San Dieguito Lagoon because would pass edge of lagoon.	Wetlands: 907 ac (367 ha) Waters: 46,750 linear ft (14,249 linear m) Special-Status Species: 37 Would improve tidal flow within coastal lagoons by replacing structures across lagoons to eliminate or reduce fill.	Wetlands: 892 ac (361 ha) Waters: 45,990 linear ft (14,018 linear m) Special-Status Species: 37 Would improve tidal flow within coastal lagoons by replacing structures across lagoons to eliminate or reduce fill.	Wetlands: 892 ac (361 ha) Waters: 45,990 linear ft (14,018 linear m) Special-Status Species: 37 Would improve tidal flow within coastal lagoons by replacing structures across lagoons to eliminate or reduce fill.

11 The biological resources and wetlands study area is defined as 1,000 ft (305 m) for urban areas, 0.25 mi (0.40 km) for undeveloped areas, and 0.5 mi (0.80 km) for sensitive areas on each side of alignment centerline.

	Proposed Rail Improvements Alternative				
	Highest Level Improvements (Short Trench/ Peñasquitos Bypass/I-5 Tunnel/ Grade Sep.)	**Highest Level Improvements (Short Trench/ Peñasquitos Bypass/UTC Tunnel/ Grade Sep.)**	**Highest Level Improvements (Short Trench/Camino del Mar & UTC Tunnels/ Grade Sep.)**	**Lowest Level Improvements (At Grade/ Camino del Mar & UTC Tunnels/Grade Sep.)**	**Lowest Level Improvements (At Grade/Camino del Mar & UTC Tunnels/At Grade)**
Section 4(f) and 6(f) Resources:[12] Number of resources rated high (potential direct effects)	Resources rated high: 14 Potential impacts on several state beaches would be limited due to use of existing rail corridors.	Resources rated high: 14 Potential impacts on several state beaches would be limited due to use of existing rail corridors.	Resources rated high: 15 Potential impacts on several state beaches would be limited due to use of existing rail corridors.	Resources rated high: 15 Potential impacts on several state beaches would be limited due to use of existing rail corridors.	Resources rated high: 15 Potential impacts on several state beaches would be limited due to use of existing rail corridors.

12 The 4(f) and 6(f) resources study area is defined as 900 ft (274m) on each side of the alignment centerline. Potential high impacts would be those that would occur within 150 ft (43 m) of alignment centerline.

5.5 LOS ANGELES TO SAN DIEGO STATION OPTIONS

Station Name (Alignment)	Discussion
North & Central Orange County	
Fullerton Amtrak Station	The Fullerton Amtrak Station would continue to serve improved Amtrak Pacific Surfliner and transcontinental trains The station in Fullerton is located within a minority population and would have low potential impacts on biological resources, visual resources, cultural and paleontological resources, public utilities, and Section 4(f) and 6(f) lands; and high potential impacts on hydrology and water quality as a result of the high potential for erosion.
Anaheim Transportation Center	The Anaheim Transportation Center is an existing transit hub with high connectivity for central Orange County. The station is a bus transit hub and serves existing Amtrak and Metrolink Commuter Rail services. The station in Anaheim would have low potential impacts on biological resources, visual resources, cultural and paleontological resource, public utilities, and Section 4(f) and 6(f) lands; and moderate potential impacts on hydrology and water quality (affecting 15 ac [6 ha] of floodplain. The site is located within a minority population.
Santa Ana Amtrak Station	The Santa Ana Amtrak Station would provide service to an improved Pacific Surfliner, Metrolink Commuter, and proposed CenterLine LRT system currently under design. The station in Santa Ana would have low potential impacts on biological resources, visual resources, cultural (specifically historical structures) and paleontological resources, hydrology and water quality, public utilities, and Section 4(f) and 6(f) lands. The site is located within a minority population.
Southern Orange County	
Irvine Transportation Center	The master site plan for the Irvine Transportation Center indicates that this station area will develop into a transit-oriented environment serving as a station stop for improved Pacific Surfliner service and Metrolink Commuter service. The Irvine Transportation Center is an existing transit hub for bus routes with high connectivity for southern Orange County. The station in Irvine would have low potential impacts on biological resources, visual resources, cultural and paleontological resources, public utilities, hydrology and water quality (affecting 5 ac [2 ha] of floodplain), and Section 4(f) and 6(f) lands at the former El Toro Marine Corps Air Station. The site is located within a minority population.
San Juan Capistrano	Depending on the alignment chosen through San Juan Capistrano, the San Juan Capistrano station would either continue to serve improved Amtrak Pacific Surfliner and Metrolink Commuter trains or would be eliminated as San Juan Capistrano would be bypassed. The station in San Juan Capistrano would have low potential impacts on biological resources, visual resources, hydrology and water quality, public utilities, and Section 4(f) and 6(f) lands. It is located within a minority population. It would have high potential impacts on paleontological resources (formations with high fossil sensitivity) and on cultural resources (six known archeological sites).
Trabuco Creek	Depending on the alignment chosen through San Juan Capistrano, a new station may be constructed along the Trabuco Creek alignment. This station would be located in a trench adjacent to Trabuco Creek, west of the existing Amtrak station. Due to its proximity to the existing downtown San Juan Capistrano Amtrak station, many of the potential environmental impacts would be similar. Potential biological and hydrological impacts may result due to the location of the station adjacent to Trabuco Creek.

Station Name (Alignment)	Discussion
San Clemente Amtrak	Two potential station locations are being considered along the alignment options for the LOSSAN corridor options. Along the short tunnel option, a station is being considered adjacent to Avenida Pico, just north of the existing Metrolink station. The second station location would be along the I-5 tunnel option, where the proposed alignment crosses Avenida Pico, just north of I-5. These stations would replace the existing Amtrak and Metrolink stations, allowing for both the Surfliner and Metrolink to continue to serve San Clemente along the potential new railroad alignments. Station sites in San Clemente would have low potential impacts on biological resources, visual resources (trenched stations), public utilities, and Section 4(f) and 6(f) lands and moderate potential impacts on geology (difficulty in excavations), hydrology and water quality (affecting 5 ac [2 ha] of floodplain), and cultural resources (specifically historical structures).
San Diego County	
Oceanside Transit Center	The Oceanside Transit Center is an existing transit hub with high connectivity for northern San Diego County. The station is a bus transit hub and serves existing Amtrak service and both Coaster and Metrolink Commuter Rail services. The station in Oceanside would have low potential impacts on public utilities, Section 4(f) and 6(f) lands, and visual resources; and moderate potential impacts on biological resources (affecting wildlife movement corridors, threatened and endangered species, and species of special concern), wetlands and non-wetland waters, hydrology and water quality (potential for erosion), and cultural resources (specifically historical structures).
Solana Beach Amtrak Station	Solana Beach Amtrak station is an existing transit hub with high connectivity for northern and central San Diego County. The station is a bus transit hub and serves existing Amtrak and Coaster Commuter Rail services.. The station in Solana Beach would have low potential impacts on visual resources, public utilities, and Section 4(f) and 6(f) lands; and moderate potential impacts on biological resources (threatened and endangered species and species of special concern), wetlands and non-wetland waters, hydrology and water quality (potential for erosion), and cultural resources (specifically historical structures).
University Towne Centre	The University Towne Centre (UTC) station site would be a deep-bore station, and the location would depend on the design option to tunnel under UTC to bypass the majority of the existing Sorrento Valley and Rose Canyon rail alignment. UTC is a densely developed portion of San Diego. The station would also be served by the Coaster commuter rail service and could have a direct connection to the regional LRT service. The station would have low potential impacts on biological resources, visual resources, public utilities, and cultural resources; and moderate potential impacts on geology (seismic hazards and difficult excavations), hydrology and water quality (erosion potential), and Section 4(f) and 6(f) lands at Mandell Weiss Eastgate Park.
San Diego Downtown–Santa Fe Depot	The Santa Fe Depot is an existing transit hub in the heart of downtown San Diego with high connectivity for coastal San Diego County. The station is a bus transit hub for several transit services and serves existing Amtrak and Coaster Commuter Rail operations. It is a major transfer station for San Diego's trolley network. The station would have low potential impacts on visual resources, hydrology and water quality, and Section 4(f) and 6(f) lands; and moderate potential impacts on biological resources (threatened and endangered species, species of special concern, and non-wetland waters), geology (seismic hazards and difficulty in excavations), public utilities (electrical facilities), and cultural resources (specifically historic structures).